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(54) **Method for improving performances of a mobile radiocommunication system using convergence assessment of power control loop**

Verfahren zur Verbesserung der Leistung eines mobilen Radiokommunikationssystems unter Feststellung der Konvergenz des Leistungs-Regelkreises

Méthode pour améliorer des performances d'un système mobile de radiocommunication en utilisant l'évaluation de convergence de la boucle de commande de puissance

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Description

[0001] The present invention is generally concerned with mobile radiocommunication systems.

[0002] The present invention is more particularly concerned with power control used in such systems to improve performances (in terms of quality of service, of capacity,...etc.).

[0003] The present invention is in particular applicable to mobile radiocommunication systems of CDMA ("Code Division Multiple Access") type. In particular, the present invention is applicable to UMTS ("Universal Mobile Telecommunication System").

[0004] One type of power control which is used in CDMA systems is the so-called closed-loop power control.

[0005] The closed loop generally runs on a fast basis in order to adjust the transmission quality (generally represented by the SIR, or "Signal-to-Interference Ratio") around a transmission quality target value (generally a SIR_{target} value), by sending appropriate power control commands back to the transmitter. The closed loop thus sends an "up" power control command back to the transmitter when the estimated SIR is below the SIR_{target} value, or a "down" power control command otherwise.

[0006] The SIR_{target} value is generally adjusted by a so-called outer loop (see for example EP-A-0709973). The outer loop generally runs on a slower basis in order to adjust the quality of service (generally represented by the BER, or "Bit Error Rate", or the FER, or "Frame Error Rate") around a quality of service target value (generally a BER or FER target value). The outer loop thus increases the SIR_{target} value when an estimated BER or FER is above a BER or FER target value, or reduces it otherwise.

[0007] Such an implementation may lead to such situations where the SIR_{target} value is needlessly increased, therefore needlessly increasing the interference level in the system.

[0008] This may in particular be the case under such conditions as when the transmitter has already reached its maximum transmit power, or when the system has become overloaded. In such a case the SIR_{target} value is uselessly increased, while this cannot result in any quality improvement. This may not be considered as a drawback in itself, as long as such conditions apply, but the SIR_{target} value may therefore reach a too high value, and, when such conditions no longer apply, this will result in setting the transmit power at a level higher than necessary, therefore needlessly increasing the interference level in the system, until the algorithm reaches a correct value again.

[0009] The outer loop is usually implemented at the receiver side, in order to reduce adaptation delays between quality measurements and SIR_{target} setting. However, the receiver may not have means to know why the quality of service cannot be maintained with the current SIR_{target} value, and, as indicated above, may try to increase it, even though the current SIR_{target} value cannot be reached due to network overload for instance.

[0010] Therefore there is a need to provide a power control method avoiding such drawbacks.

[0011] An object of the present invention is therefore a method for improving performances of a mobile radiocommunication system using a power control loop which controls power according to a transmission quality target value, and an adjustment process for adjusting said transmission quality target value, a method wherein said adjustment process is controlled based on an assessment of the convergence of said power control loop around said transmission quality target value.

[0012] According to another object of this invention, said control of said adjustment process includes not performing any adjustment, if said power control loop has not converged around said transmission quality target value.

[0013] According to another object of this invention, convergence of said power control loop is assessed by determining if a difference between an estimated average transmission quality and said transmission quality target value is within given margins.

[0014] According to another object of this invention, said margins are determined so as to take into account power control errors.

[0015] According to another object of this invention, said margins are optimised according to radio conditions.

[0016] According to another object of this invention, said margins are different depending on whether said adjustment requires increasing or reducing said transmission quality target value.

[0017] According to another object of this invention, said estimated average transmission transmission quality is estimated on an averaging period which is long enough to enable said power control loop to converge, but not too long to take into account fast changes in power control requirements.

[0018] According to another object of this invention, said averaging period is optimised according to radio conditions.

[0019] According to another object of this invention, convergence of said loop is assessed by determining if, among successive values representative of an estimated average transmission quality, at least one of these values is above said transmission quality target value and at least one of these values is below said transmission quality target value.

[0020] According to another object of this invention, said transmission quality is represented by a Signal-to-Interference Ratio (SIR).

[0021] According to another object of this invention, said adjustment process is an outer loop which adjusts a quality of service around a quality of service target value.

[0022] According to another object of the invention, said mobile radiocommunication system is of CDMA type.

[0023] According to another object of the invention, said power control is performed in an uplink transmission direction of said mobile radiocommunication system, using an uplink power control loop and an uplink adjustment process, and said uplink adjustment process is controlled, based on an assessement of the convergence of said uplink power control loop.

[0024] According to another object of the invention, said power control is performed in a downlink transmission direction of said mobile radiocommunication system, using a downlink power control loop and a downlink adjustment process, and said downlink adjustment process is controlled, based on an assessement of the convergence of said downlink power control loop.

[0025] The present invention also has for its object a mobile radiocommunication network for performing such a method, said mobile radiocommunication network comprising means for performing said uplink power control loop, means for performing said uplink adjustment process, and means for controlling said uplink adjustment process, based on an assessment of the convergence of said uplink power control loop.

[0026] According to another object of this invention, said mobile radiocommunication network is of the type comprising at least one base station, comprising means for performing said uplink power control loop, and at least one base station controller, comprising means for performing said uplink adjustment process.

[0027] According to another object of this invention, a base station of such a network comprises:

- means for performing measurements necessary for the assessment of the convergence of said uplink power control loop,
- means for sending such measurements to a base station controller.

[0028] According to another object of this invention, a base station controller of such a network comprises:

- means for receiving such measurements from a base station,
- means for assessing the convergence of said uplink power control loop, based on such measurements , and for controlling said uplink adjustment process, based on this assessment.

[0029] The present invention also has for its object a mobile station for performing such a method, said mobile station comprising means for performing said downlink power control loop, means for performing said downlink adjustment process, and means for controlling said downlink adjustment process, based on an assessment of the convergence of said downlink power control loop.

[0030] According to another object of this invention, such a mobile station comprises:

- means for performing measurements necessary for the assessment of the convergence of said downlink power control loop,
- means for assessing the convergence of said downlink power control loop, based on such measurements, and for controlling said downlink adjustment process, based on this assessment.

[0031] According to another object of this invention, such a mobile station further comprises means for receiving parameters required for said assessment of convergence of said downlink power control loop, from a mobile radiocommunication network.

[0032] These and other objects of the present invention will become more apparent from the following description taken in conjunction with the accompanying drawings:

- figure 1 is a diagram intended to illustrate a method according to the invention,
- figure 2 is a diagram intended to illustrate the general architecture of the radio access network, or "UTRAN" ("UMTS Terrestrial Radio Access Network"), of UMTS system,
- figure 3 is a diagram intended to illustrate an example of means which may be used in an entity like a base station or Node B of UTRAN, and in an entity like a base station controller or SRNC of UTRAN, to perform a method according to the present invention, for uplink power control,
- figure 4 is a diagram intended to illustrate an example of means which may be used in a mobile station, or user equipment (UE) to perform a method according to the present invention, for downlink power control.

[0033] The present invention thus has for its object a method for improving performances of a mobile radiocommunication system using a power control loop which controls power according to a transmission quality target value, and an adjustment process for adjusting said transmission quality target value, a method wherein said adjustment process is controlled, based on an assessment of the convergence of said power control loop around said transmission quality

target value.

[0034] Such a method may be illustrated by the diagram of figure 1, where:

- 1 refers to a power control loop,
- 2 refers to said adjustment process,
- 3 refers to an assessment of the convergence of said power control loop,
- 4 refers to a control of said adjustment process, based on said assessment.

[0035] Generally, such a method enables to optimise performances, by optimising the adjustment process.

[0036] In particular, by providing that no adjustment of the transmission quality target value is performed if said power control loop has not yet converged around this target value, this enables to avoid the above mentioned drawbacks.

[0037] Still in particular, by considering the current case where the adjustment process is the outer loop algorithm as mentioned above, and the power control loop is the closed loop as mentioned above, this may be expressed by the following algorithm:

If outer loop algorithm requests a change of SIR_{target},
  If closed loop power control has converged, the request is accepted
  Else the request is rejected.

[0038] An example of implementation of such an algorithm may be expressed as follows:

$$\text{If } (Avgd\_FER < FER_{target}) \text{ and } (|SIR_{av} - SIR_{target}| < \eta),\ SIR_{target} = SIR_{target} - SIR_{dec\_step}$$

$$\text{if } (Avgd\_FER > FER_{target}) \text{ and } (|SIR_{av} - SIR_{target}| < \varepsilon),\ SIR_{target} = SIR_{target} + SIR_{inc\_step}$$

[0039] In this example SIR_{inc_step} and SIR_{dec_step} are the specified steps for updating (increasing, respectively decreasing) SIR_{target} values.

[0040] In this example $(Avgd\_FER < FER_{target})$ or $(Avgd\_FER > FER_{target})$ are the conditions in which the outer loop requests updating SIR_{target}, where:

- *Avgd_FER* is a measured FER averaged over a given period. Other quality parameters could be used such as Block Error Rate, number of retransmissions of PDU in RLC for packet services, etc.
- FER_{target} is the FER target value specified for the bearer service (given at call or session set up).

[0041] In this example, convergence of the power control closed loop is assessed by determining if the difference between an estimated average transmission quality and said transmission quality target value is within given margins, i.e. if

$$(|SIR_{av} - SIR_{target}| < \eta) \text{ or } (|SIR_{av} - SIR_{target}| < \varepsilon)$$

where :

- SIR_{target} is the SIR target value set by the outer loop algorithm and used by the dosed loop power control
- SIR_{av} is the SIR measured and averaged over a given averaging period. This averaging period is a parameter of the system that may be optimised according to radio conditions. It should start at least after the last change in SIR_{target} value, should be long enough to allow the dosed loop to reach the new value, but should not be too long to identify fast changes in case of overload situations for instance
- ε, η are margins related to the difference between SIR_{av} measurements and SIR target values (for the case where SIR_{target} needs to be increased, respectively decreased), taking into account power control errors. These parameters may also be optimised according to radio conditions.

[0042] Other examples may be envisaged to assess the convergence of the closed loop power control. For instance, it may be considered that the closed loop has converged, when among successive values of SIR_{av}, at least one of these values is below SIR_{target} and at least one of these values is above SIR_{target}.

[0043] Besides, it should be noted that parameters other than SIR might be used to assess the convergence of the

closed loop power control, to take into account non precise measurements in case of bad SIR estimation (for low SIR values in particular).

[0044] The present invention may be applied to uplink power control, downlink power control, or both uplink and downlink power control.

[0045] As compared to known methods, the method according to the invention may require additional measurements as well as additional signalling to be performed.

[0046] As an example, an application of the present invention to the UTRAN architecture of UMTS will be disclosed in the following.

[0047] As recalled in figure 2, the current UTRAN architecture comprises:

- base stations, called "Node B", which communicate with mobile stations or "User Equipments" (UE) via a radio interface called "Uu",
- base station controllers, called "Radio Network Controllers" or RNC, which communicate with Nodes B via an interface called "Iub" (each RNC controlling a plurality of Nodes B).

[0048] Within this architecture, for uplink power control the closed loop is currently implemented in Node B, while the outer loop is currently implemented in RNC; for downlink power control both loops are currently implemented in UE.

[0049] A method according to the invention may then require additional measurements to be performed, in Node B for uplink power control and in UE for downlink power control, as well as additional signalling to be performed between Node B and RNC at the interface Iub, for uplink power control.

[0050] As illustrated at figure 3, a Node B may therefore comprise, besides other means which may be classical and which are not mentioned here:

- means 10 for performing measurements required for the assessment of convergence of the uplink power control loop,
- means 11 for sending such measurements to RNC.

[0051] As illustrated at figure 3, a RNC may therefore comprise, besides other means which may be classical and which are not mentioned here:

- means 13 for receiving such measurements from Node B,
- means 14 for assessing the convergence of said uplink power control loop, based on such measurements, and for controlling the uplink adjustment process, or uplink outer loop, based on this assessment.

[0052] Means like 10, 11, 13, 14 work together so as to perform the above disclosed method, for uplink power control. Such means do not need to be more fully disclosed than by their above disclosed function, for a person skilled in the art. Besides, the required signalling may be performed according to known types of signalling procedures in such types of systems, and therefore does not either require to be more fully disclosed, for a person skilled in the art.

[0053] For example, the measurements required for the assessment of convergence, and sent by Node B to RNC across the Iub interface, may be sent in band with data PDU ("Packet Data Unit") or out of band.

[0054] For example, such measurements as SIR_{av} (such as SIR averaged over the transmission time period of a data frame) may be sent in band for each uplink data frame.

[0055] As illustrated at figure 4, a User Equipment UE may comprise, besides other means which may be classical and which are not mentioned here:

- means 15 for performing measurements required for the assessment of convergence of the downlink power control dosed loop,
- means 16 for assessing said convergence, based on such measurements, and for controlling the downlink adjustment process, or downlink outer loop, based on this assessment.

[0056] No additionnal signalling is therefore required for downlink power control.

[0057] However, parameters necessary for the assessment of convergence , such as for instance parameter ε referred to in the above disdosed example may need to be signalled to each UE, in case network control on said downlink adjustment control would be needed. Alternatively, parameter ε for instance may be evaluated by the UE from past measurements.

[0058] Means like 15, 16 work together so as to perform the above disclosed method, for downlink power control. Such means do not either require to be more fully disclosed than by their above disclosed function, for a person skilled in the art.

Claims

1. A method for improving performances of a mobile radiocommunication system, a method including the steps of:

   - controlling power according to a transmission quality target value, using a power control loop (1),
   - adjusting said transmisson quality target value, using an adjustment process (2),
   - assessing the convergence of said power control loop around said transmission quality target value (3),
   - controlling said adjustment process, based on said assessment (4).

2. A method according to claim 1, wherein said step of controlling said adjustment process includes not performing any adjustment, if said power control loop has not converged around said transmission quality target value.

3. A method according to claim 1 or 2, wherein said said step of controlling said adjustment process includes not increasing said transmission quality target value if said power control loop has not converged around said transmission quality target value.

4. A method according to any of claims 1 to 3, wherein said step of assessing the convergence of said power control loop around said transmission quality target value includes comparing an average measured transmission quality to said transmission quality target value.

5. A method according to any of claims 1 to 4, wherein said step of assessing the convergence of said power control loop includes determining if a difference between an estimated average transmission quality and a current transmission quality target value is within given margins.

6. A method according to claim 5, wherein said margins are determined so as to take into account power control errors.

7. A method according to claim 5, wherein said margins are optimised according to radio conditions.

8. A method according to claim 5 , wherein said margins are different depending on whether said adjustment requires increasing or reducing said transmission quality target value.

9. A method according to claim 5, wherein said estimated average transmission transmission quality is estimated on an averaging period which is long enough to enable said power control loop to converge, but not too long to take into account fast changes in power control requirements.

10. A method according to claim 5, wherein said averaging period is optimised according to radio conditions.

11. A method according to any of claims 1 to 4, wherein said step of assessing the convergence of said power control loop around said transmission quality target value includes determining if, among successive values representative of on estimated average transmission quality, at least one of these values is above said transmission quality target value and at least one of these values is below said transmission quality target value.

12. A method according to any of claims 1 to 11, wherein said transmission quality is represented by a Signal-to-Interference Ratio.

13. A method according to any of claims 1 to 12, wherein said adjustment process is an outer loop which adjusts a quality of service around a quality of service target value.

14. A method according to any of claims 1 to 13, wherein said mobile radiocommunication system is of CDMA type.

15. A method according to any of claims 1 to 14, including the steps of:

   - controlling power according to a transmission quality target value, using an uplink power control loop,
   - adjusting said transmisson quality target value, using an uplink adjustment process,
   - assessing the convergence of said uplink power control loop around said transmission quality target value,
   - controlling said uplink adjustment process, based on said assessment.

16. A method according to any of claims 1 to 14, including the steps of:

- controlling power according to a transmission quality target value, using a downlink power control loop,
- adjusting said transmisson quality target value, using a downlink adjustment process,
- assessing the convergence of said downlink power control loop around said transmission quality target value,
- controlling said downlink adjustment process, based on said assessment.

17. A mobile radiocommunication network suitable for performing a method according to claim 15, said mobile radiocommunication network comprising:

- means arranged for controlling power according to a transmission quality target value, using an uplink power control loop,
- means arranged for adjusting said transmisson quality target value, using an uplink adjustment process,
- means arranged for assessing the convergence of said uplink power control loop around said transmission quality target value,
- means arranged for controlling said uplink adjustment process based on said assessment.

18. A mobile radiocommunication network according to claims 17, said mobile radiocommunication network being of the type comprising at least one base station, comprising means for performing said uplink power control loop, and at least one base station controller, comprising means for performing said uplink adjustment process.

19. A base station (Node B) of a mobile radiocommunication network according to claim 18, comprising:

- means (10) arranged for performing measurements necessary for the assessment of the convergence of said uplink power control loop around said transmission quality target value,
- means (11) for sending such measurements to a base station controller.

20. A base station controller (RNC) of a mobile radiocommunication network according to claim 18, comprising:

- means (13) arranged for receiving measurements necessary for the assessment of the convergence of said uplink power control loop around said transmission quality target value, from a base station,
- means (14) arranged for assessing the convergence of said uplink power control loop around said transmission quality target value, based on such measurements, and for controlling said uplink adjustment process, based on this assessment.

21. A mobile station suitable for performing a method according to claim 16, said mobile station comprising:

- means arranged for controlling power according to a transmission quality target value, using a downlink power control loop,
- means arranged for adjusting said transmisson quality target value, using a downlink adjustment process,
- means for assessing the convergence of said downlink power control loop around said transmission quality target value,
- means arranged for controlling said downlink adjustment process based on said assessment.

22. A mobile station (UE) according to claim 21, wherein said means arranged for controlling said downlink adjustment process based on an assessment of the convergence of said downlink power control loop around said transmission quality target value include means for not increasing said transmission quality target value if said power control loop has not converged around said transmission quality target value.

23. A mobile station (UE) according to claim 21 or 22, wherein said means for assessing the convergence of said power control loop around said transmission quality target value includes means arranged for comparing an averaged measured transmission quality to said transmission quality target value.

24. A mobile station (UE) according to any of claims 21 to 23, comprising:

- means (15) arranged for performing measurements necessary for the assessment of the convergence of said downlink power control loop around said transmission quality target value,
- means (16) arranged for assessing the convergence of said downlink power control loop around said transmission quality target value, based on such measurements, and for controlling said downlink adjustment process, based on this assessment.

25. A mobile station according to claim 24, further comprising means arranged for receiving parameters required for said assessment of convergence of said downlink power control loop around said transmission quality target value, from a mobile radiocommunication network.

26. A mobile radiocommunication system, including at least one mobile station according to any of claims 21 to 25.

Patentansprüche

1. Ein Verfahren zur Verbesserung der Leistung eines mobilen Funkkommunikationssystems, wobei das Verfahren folgende Schritte umfasst:

   - Regelung der Leistung entsprechend eines Übertragungsqualitäts-Zielwertes unter Verwendung einer Leistungs-Regelschleife (1),
   - Einstellung des Übertragungsqualitäts-Zielwertes unter Verwendung eines Einstellprozesses (2),
   - Beurteilung der Konvergenz der Leistungs-Regelschleife um den Übertragungsqualitäts-Zielwert (3),
   - Steuerung des Einstellprozesses auf der Grundlage der Beurteilung (4).

2. Ein Verfahren gemäß Anspruch 1, worin der Schritt der Steuerung des Einstellprozesses es umfasst, keine Einstellung durchzuführen, wenn die Leistungs-Regelschleife nicht um den Übertragungsqualitäts-Zielwert konvergiert hat.

3. Ein Verfahren gemäß Anspruch 1 oder 2, worin der Schritt der Steuerung des Einstellprozesses es umfasst, den Übertragungsqualitäts-Zielwert nicht zu erhöhen, wenn die Leistungs-Regelschleife nicht um den Übertragungsqualitäts-Zielwert konvergiert hat.

4. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 3, worin der Schritt der Beurteilung der Konvergenz der Leistungs-Regelschleife um den Übertragungsqualitäts-Zielwert den Vergleich einer gemittelten gemessenen Übertragungsqualität mit dem Übertragungsqualitäts-Zielwert umfasst.

5. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 4, worin der Schritt der Beurteilung der Konvergenz der Leistungs-Regelschleife die Feststellung umfasst, ob eine Differenz zwischen einer geschätzten mittleren Übertragungsqualität und einem aktuellen Übertragungsqualitäts-Zielwert sich innerhalb gegebener Grenzen befindet.

6. Ein Verfahren gemäß Anspruch 5, worin die Grenzen so bestimmt werden, dass Leistungsregelungs-Fehler berücksichtigt werden.

7. Ein Verfahren gemäß Anspruch 5, worin die Grenzen entsprechend der Funkbedingungen optimiert werden.

8. Ein Verfahren gemäß Anspruch 5, worin die Grenzen unterschiedlich sind, abhängig davon, ob die Einstellung eine Erhöhung oder Verringerung des Übertragungsqualitäts-Zielwertes erfordert.

9. Ein Verfahren gemäß Anspruch 5, worin die geschätzte mittlere Übertragungsqualität über eine Mittelwertbildungs-Periode bestimmt wird, die lang genug ist, um es zu ermöglichen, dass die Leistungs-Regelschleife konvergiert, aber nicht zu lang, damit schnelle Änderungen der Anforderungen an die Leistungsregelung berücksichtigt werden.

10. Ein Verfahren gemäß Anspruch 5, worin die Mittelwertbildungs-Periode entsprechend der Funkbedingungen optimiert wird.

11. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 4, worin der Schritt der Beurteilung der Konvergenz der Leistungs-Regelschleife um den Übertragungsqualitäts-Zielwert die Feststellung umfasst, ob unter aufeinander folgenden Werten, die für eine geschätzte mittlere Übertragungsqualität repräsentativ sind, mindestens einer dieser Werte über dem Übertragungsqualitäts-Zielwert und mindestens einer dieser Werte unter dem Übertragungsqualitäts-Zielwert liegt.

12. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 11, worin die Übertragungsqualität durch einen Störabstand repräsentiert wird.

13. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 12, worin der Einstellprozess eine äußere Schleife ist, mit der eine Dienstqualität um einen Dienstqualitäts-Zielwert eingestellt wird.

14. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 13, worin das mobile Funkkommunikationssystem vom CDMA-Typ ist.

15. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 14, das folgende Schritte umfasst:

- Regelung der Leistung entsprechend eines Übertragungsqualitäts-Zielwertes unter Verwendung einer Leistungs-Regelschleife in Aufwärtsrichtung,
- Einstellung des Übertragungsqualitäts-Zielwertes unter Verwendung eines Einstellprozesses in Aufwärtsrichtung,
- Bewertung der Konvergenz der Leistungs-Regelschleife in Aufwärtsrichtung um den Übertragungsqualitäts-Zielwert,
- Steuerung des Einstellprozesses in Aufwärtsrichtung auf der Grundlage der Bewertung.

16. Ein Verfahren gemäß einem beliebigen der Ansprüche 1 bis 14, das folgende Schritte umfasst:

- Regelung der Leistung entsprechend eines Übertragungsqualitäts-Zielwertes unter Verwendung einer Leistungs-Regelschleife in Abwärtsrichtung,
- Einstellung des Übertragungsqualitäts-Zielwertes unter Verwendung eines Einstellprozesses in Abwärtsrichtung,
- Bewertung der Konvergenz der Leistungs-Regelschleife in Abwärtsrichtung um den Übertragungsqualitäts-Zielwert,
- Steuerung des Einstellprozesses in Abwärtsrichtung auf der Grundlage der Bewertung.

17. Ein mobiles Funkkommunikationsnetz, das zur Durchführung eines Verfahrens gemäß Anspruch 15 geeignet ist, wobei das mobile Funkkommunikationsnetz folgendes umfasst:

- Mittel zur Regelung der Leistung entsprechend eines Übertragungsqualitäts-Zielwertes unter Verwendung einer Leistungs-Regelschleife in Aufwärtsrichtung,
- Mittel zur Einstellung des Übertragungsqualitäts-Zielwertes unter Verwendung eines Einstellprozesses in Aufwärtsrichtung,
- Mittel zur Bewertung der Konvergenz der Leistungs-Regelschleife in Aufwärtsrichtung um den Übertragungsqualitäts-Zielwert,
- Mittel zur Steuerung des Einstellprozesses in Aufwärtsrichtung auf der Grundlage der Bewertung.

18. Ein mobiles Funkkommunikationsnetz gemäß Anspruch 17, wobei das mobile Funkkommunikationsnetz von dem Typ ist, der mindestens eine Basisstation enthält, die Mittel zur Durchführung der Leistungs-Regelschleife in Aufwärtsrichtung umfasst, und der mindestens einen Basisstations-Controller enthält, der Mittel zur Durchführung des Einstellprozesses in Aufwärtsrichtung umfasst.

19. Eine Basisstation (Knoten B) eines mobilen Funkkommunikationsnetzes gemäß Anspruch 18, die folgendes umfasst:

- Mittel (10) zur Durchführung von Messungen, die für die Bewertung der Konvergenz der Leistungs-Regelschleife in Aufwärtsrichtung um den Übertragungsqualitäts-Zielwert erforderlich sind,
- Mittel (11) zum Senden solcher Messwerte zu einem Basisstations-Controller.

20. Ein Basisstations-Controller (RNC) eines mobilen Funkkommunikationsnetzes gemäß Anspruch 18, der folgendes umfasst:

- Mittel (13) zum Empfang von Messwerten von einer Basisstation, die für die Bewertung der Konvergenz der Leistungs-Regelschleife in Aufwärtsrichtung um den Übertragungsqualitäts-Zielwert erforderlich sind,
- Mittel (14) zur Bewertung der Konvergenz der Leistungs-Regelschleife in Aufwärtsrichtung um den Übertragungsqualitäts-Zielwert auf der Grundlage solcher Messungen und zur Steuerung des Einstellprozesses in Aufwärtsrichtung auf der Grundlage dieser Bewertung.

21. Eine Mobilstation, die zur Durchführung eines Verfahrens gemäß Anspruch 16 geeignet ist, wobei die Mobilstation folgendes umfasst:

- Mittel zur Regelung der Leistung entsprechend eines Übertragungsqualitäts-Zielwertes unter Verwendung einer Leistungs-Regelschleife in Abwärtsrichtung,
- Mittel zur Einstellung des Übertragungsqualitäts-Zielwertes unter Verwendung eines Einstellprozesses in Abwärtsrichtung,
- Mittel zur Bewertung der Konvergenz der Leistungs-Regelschleife in Abwärtsrichtung um den Übertragungsqualitäts-Zielwert,
- Mittel zur Steuerung des Einstellprozesses in Abwärtsrichtung auf der Grundlage der Bewertung.

22. Eine Mobilstation (UE) gemäß Anspruch 21, worin die Mittel zur Steuerung des Einstellprozesses in Abwärtsrichtung auf der Grundlage einer Bewertung der Konvergenz der Leistungs-Regelschleife in Abwärtsrichtung um den Übertragungsqualitäts-Zielwert Mittel enthalten, um den Übertragungsqualitäts-Zielwert nicht zu erhöhen, wenn die Leistungs-Regelschleife nicht um den Übertragungsqualitäts-Zielwert konvergiert hat.

23. Eine Mobilstation (UE) gemäß Anspruch 21 oder 22, worin die Mittel zur Bewertung der Konvergenz der Leistungs-Regelschleife um den Übertragungsqualitäts-Zielwert Mittel enthalten, um eine gemittelte gemessene Übertragungsqualität mit dem Übertragungsqualitäts-Zielwert zu vergleichen.

24. Eine Mobilstation (UE) gemäß einem beliebigen der Ansprüche 21 bis 23, die folgendes umfasst:

- Mittel (15) zur Durchführung von Messungen, die für die Bewertung der Konvergenz der Leistungs-Regelschleife in Abwärtsrichtung um den Übertragungsqualitäts-Zielwert erforderlich sind,
- Mittel (16) zur Bewertung der Konvergenz der Leistungs-Regelschleife in Abwärtsrichtung um den Übertragungsqualitäts-Zielwert auf der Grundlage solcher Messungen und zur Steuerung des Einstellprozesses in Abwärtsrichtung auf der Grundlage dieser Bewertung.

25. Eine Mobilstation gemäß Anspruch 24, die weiterhin Mittel zum Empfang von Parametern von einem mobilen Funkkommunikationsnetz enthält, die für die Bewertung der Konvergenz der Leistungs-Regelschleife in Abwärtsrichtung um den Übertragungsqualitäts-Zielwert erforderlich sind.

26. Ein mobiles Funkkommunikations-System, das mindestens eine Mobilstation gemäß einem beliebigen der Ansprüche 21 bis 25 enthält.

Revendications

1. Procédé pour améliorer des performances d'un système de radiocommunication mobile, un procédé comprenant les étapes de :

- commande d'une puissance selon une valeur cible de qualité d'émission, en utilisant une boucle de commande de puissance (1) ;
- ajustement de ladite valeur cible de qualité d'émission, en utilisant un traitement d'ajustement (2) ;
- évaluation de la convergence de ladite boucle de commande de puissance autour de ladite valeur cible de qualité d'émission (3) ;
- commande dudit traitement d'ajustement sur la base de ladite évaluation (4).

2. Procédé selon la revendication 1, dans lequel ladite étape de commande dudit traitement d'ajustement ne comprend pas d'ajustement quelconque, si ladite boucle de commande de puissance n'a pas convergé autour de ladite valeur cible de qualité d'émission.

3. Procédé selon la revendication 1 ou 2, dans lequel ladite étape de commande dudit traitement d'ajustement ne comprend pas de diminution de ladite valeur cible de qualité d'émission si ladite boucle de commande de puissance n'a pas convergé autour de ladite valeur cible de qualité d'émission.

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel ladite étape d'évaluation de la convergence de ladite boucle de commande de puissance autour de ladite valeur cible de qualité d'émission comprend la com-

paraison d'une qualité d'émission mesurée moyenne à ladite valeur cible de qualité d'émission.

5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel ladite étape d'évaluation de la convergence de ladite boucle de commande de puissance comprend la détermination de si une différence entre une qualité d'émission moyenne estimée et une valeur cible de qualité d'émission est dans des marges données.

6. Procédé selon la revendication 5, dans lequel lesdites marges sont déterminées afin de prendre en compte des erreurs de commande de puissance.

7. Procédé selon la revendication 5, dans lequel lesdites marges sont optimisées selon des conditions radio.

8. Procédé selon la revendication 5, dans lequel lesdites marges sont différentes en fonction de si ledit ajustement nécessaire augmente ou réduit ladite valeur cible de qualité d'émission.

9. Procédé selon la revendication 5, dans lequel ladite qualité d'émission moyenne estimée est estimée sur une période moyenne qui est suffisamment longue pour permettre à ladite boucle de commande de puissance de converger, mais pas trop longue pour prendre en compte des variations rapides dans des exigences de commande de puissance.

10. Procédé selon la revendication 5, dans lequel ladite période moyenne est optimisée selon des conditions de radio.

11. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel ladite étape d'évaluation de la convergence de ladite boucle est évaluée en déterminant si, parmi des valeurs successives représentatives d'une qualité d'émission moyenne estimée, au moins l'une de ces valeurs est en dessous de ladite valeur cible de qualité d'émission et au moins l'une de ces valeurs est en dessus de ladite valeur cible de qualité d'émission.

12. Procédé selon l'une quelconque des revendications 1 à 11, dans lequel ladite qualité d'émission est représentée par un rapport signal sur interférence.

13. Procédé selon l'une quelconque des revendications 1 à 12, dans lequel ledit traitement d'ajustement est une boucle externe qui ajuste une qualité de service autour d'une qualité de valeur cible de service.

14. Procédé selon l'une quelconque des revendications 1 à 13, dans lequel ledit système de radiocommunication mobile est de type CDMA.

15. Procédé selon l'une quelconque des revendications 1 à 14, comprenant les étapes :

- commande d'une puissance selon une valeur cible de qualité d'émission, en utilisant une boucle de commande de puissance de liaison montante ;
- ajustement de ladite valeur cible de qualité d'émission, en utilisant un traitement d'ajustement de liaison montante ;
- évaluation de la convergence de ladite boucle de commande de puissance de liaison montante autour de ladite valeur cible de qualité d'émission ;
- commande dudit traitement d'ajustement liaison montante sur la base de ladite évaluation.

16. Procédé selon l'une quelconque des revendications 1 à 14 comprenant les étapes de:

- commande d'une puissance selon une valeur cible de qualité d'émission, en utilisant une boucle de commande de puissance de liaison descendante;
- ajustement de ladite valeur cible de qualité d'émission, en utilisant un traitement d'ajustement de liaison descendante ;
- évaluation de la convergence de ladite boucle de commande de puissance de liaison descendante autour de ladite valeur cible de qualité d'émission ;
- commande dudit traitement d'ajustement de liaison descendante sur la base de ladite évaluation.

17. Réseau de radiocommunication mobile utilisable pour réaliser un procédé selon la revendication 15, ledit réseau de radiocommunication mobile comprenant :

- un moyen disposé pour commander une puissance selon une valeur cible de qualité d'émission, en utilisant une boucle de commande de puissance de liaison montante ;
- un moyen disposé pour ajuster ladite valeur cible de qualité d'émission, en utilisant un traitement d'ajustement de liaison montante ;
- un moyen disposé pour évaluer la convergence de ladite boucle de commande de puissance de liaison montante autour de ladite valeur cible de qualité d'émission ;
- un moyen disposé pour commander ledit traitement d'ajustement de liaison montante sur la base de ladite évaluation.

18. Réseau de radiocommunication mobile selon l'une quelconque des revendications 17, ledit réseau de radiocommunication mobile étant du type comprenant au moins une station de base, comprenant un moyen pour réaliser ladite boucle de commande de puissance de liaison montante, et au moins un dispositif de commande de station de base, comprenant un moyen pour réaliser ledit traitement d'ajustement de liaison montante.

19. Station de base (noeud B) d'un réseau de radiocommunication mobile selon la revendication 18, comprenant :

- un moyen (10) disposé pour réaliser des mesures nécessaires pour l'évaluation de la convergence de ladite boucle de commande de puissance de liaison montante autour de ladite valeur cible de qualité d'émission ;
- un moyen (11) pour envoyer ces mesures à un dispositif de commande de station de base.

20. Dispositif de commande de station de base (RNC) d'un réseau de radiocommunication mobile selon la revendication 18, comprenant :

- un moyen (13) disposé pour recevoir des mesures nécessaires pour l'évaluation de la convergence de la boucle de commande de puissance de liaison montante autour de ladite valeur cible de qualité d'émission d'une station de base ;
- un moyen (14) disposé pour évaluer la convergence de ladite boucle de commande de puissance de liaison montante autour de la valeur cible de qualité d'émission sur la base de ces mesures, et pour commander ledit traitement d'ajustement de liaison montante sur la base de cette évaluation.

21. Station mobile utilisable pour réaliser un procédé selon la revendication 16, ladite station mobile comprenant :

- un moyen disposé pour commander une puissance selon une valeur cible de qualité d'émission, en utilisant une boucle de commande de puissance de liaison descendante ;
- un moyen disposé pour ajuster ladite valeur cible de qualité d'émission, en utilisant un traitement d'ajustement de liaison descendante
- un moyen pour évaluer la convergence de ladite boucle de commande de puissance de liaison descendante autour de ladite valeur cible de qualité d'émission ;
- un moyen disposé pour commander ledit traitement d'ajustement de liaison descendante sur la base de ladite évaluation.

22. Station mobile (UE) selon la revendication 21, dans laquelle ledit moyen disposé pour commander ledit traitement d'ajustement de liaison descendante sur la base d'une évaluation de la convergence de ladite boucle de commande de puissance de liaison descendante autour de ladite valeur cible de qualité d'émission comprend un moyen pour ne par augmenter ladite valeur cible de qualité d'émission si ladite boucle de commande de puissance n'a pas convergé autour de ladite valeur cible de qualité d'émission.

23. Station mobile (UE) selon la revendication 21 ou 22, dans laquelle ledit moyen pour évaluer la convergence de ladite boucle de commande de puissance autour de ladite valeur cible de qualité d'émission comprend un moyen disposé pour comparer une qualité d'émission mesurée moyenne à ladite valeur cible de qualité d'émission.

24. Station mobile (UE) selon l'une quelconque des revendications 21 à 23, comprenant :

- un moyen (15) disposé pour réaliser des mesures nécessaires pour l'évaluation de la convergence de ladite boucle de commande de puissance de liaison descendante autour de ladite valeur cible de qualité d'émission ;
- un moyen (16) disposé pour évaluer la convergence de ladite boucle de commande de puissance de liaison descendante autour de ladite valeur cible de qualité d'émission sur la base de ces mesures, et pour commander ledit traitement d'ajustement de liaison descendante sur la base de cette évaluation.

25. Station mobile selon la revendication 24, comprenant en outre un moyen disposé pour recevoir des paramètres nécessaires pour ladite évaluation de convergence de ladite boucle de commande de puissance de liaison descendante autour de ladite valeur cible de qualité d'émission, à partir d'un réseau de radiocommunication mobile.

26. Système de radiocommunication mobile, comprenant au moins une station mobile selon l'une quelconque des revendications 21 à 25.

FIG_1

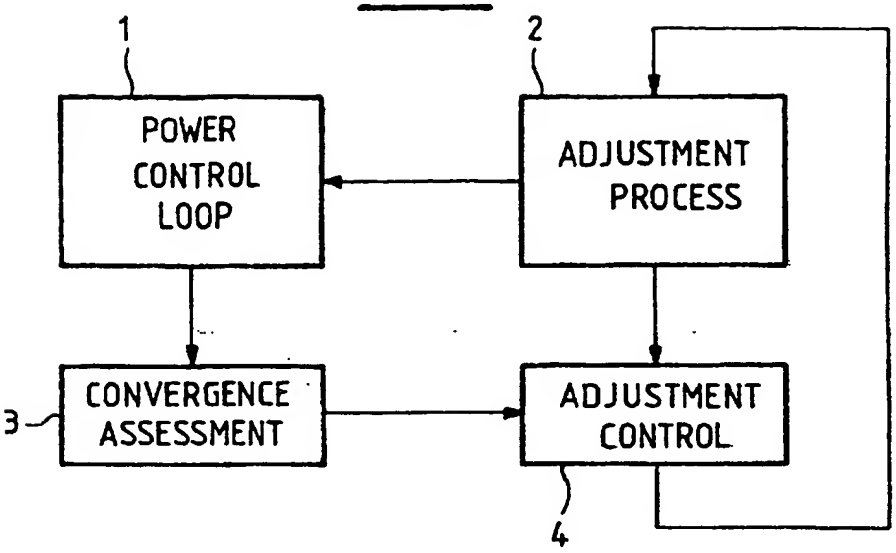
1
2
POWER CONTROL LOOP
ADJUSTMENT PROCESS
3
CONVERGENCE ASSESSMENT
ADJUSTMENT CONTROL
4

FIG_2

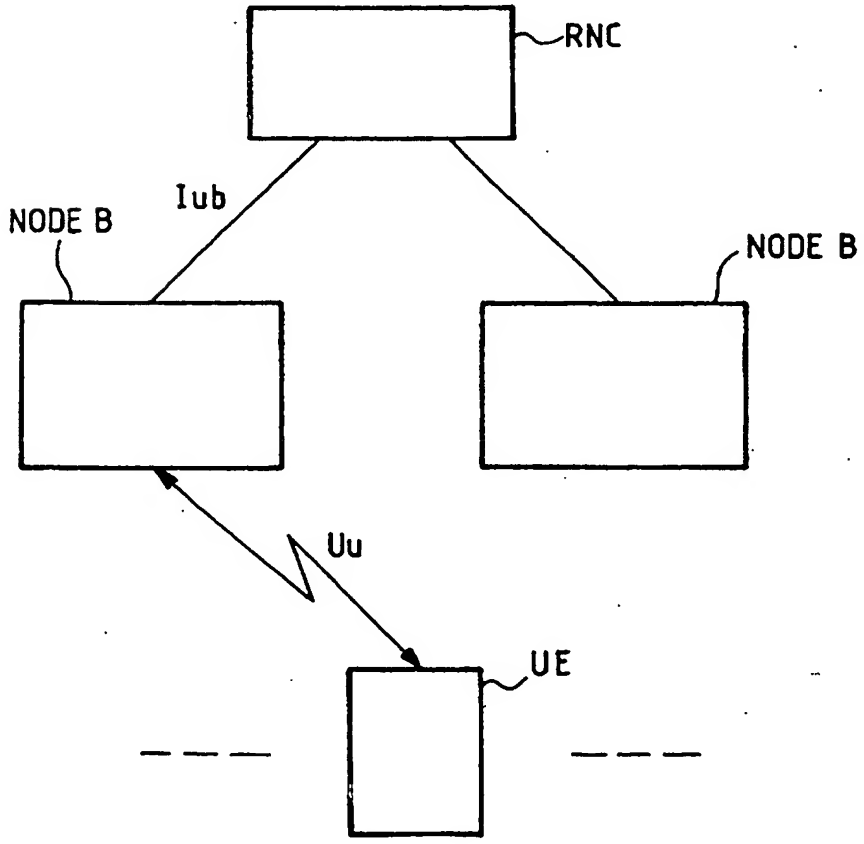
RNC
Iub
NODE B
NODE B
Uu
UE

FIG_3

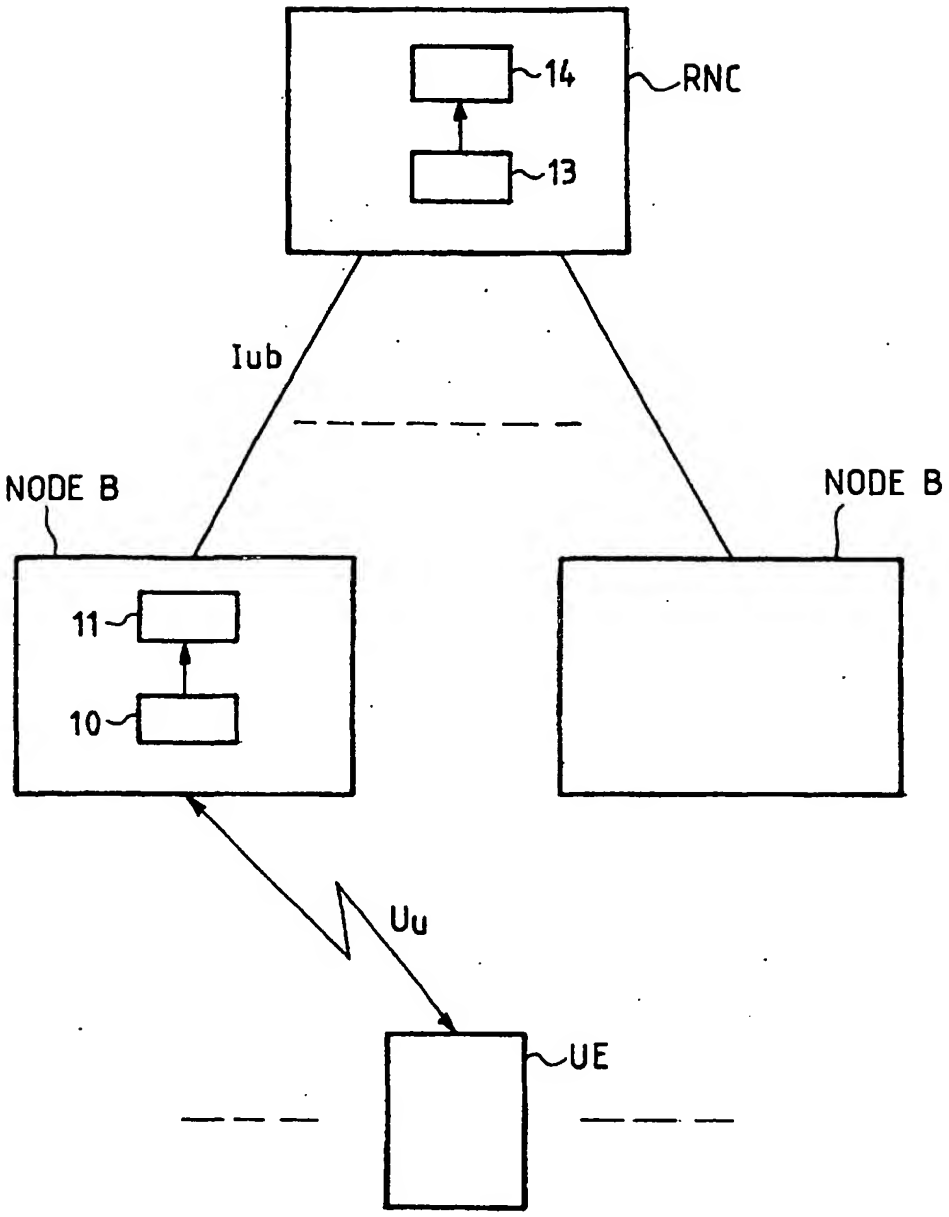

FIG_4